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Increased Rates of Morbidity, Mortality, and Charges for Hospitalized Children With Public or No Health Insurance as Compared With Children With Private Insurance in Colorado and the United States

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ABSTRACT

BACKGROUND. There has been a gradual decrease in the proportion of children covered by private health insurance in Colorado and the United States with a commensurate increase in those with public insurance or having no insurance which may impact access to care and outcomes.

OBJECTIVE. The purpose of this work was to determine whether children with public or no health insurance have differences in hospital admission rates, morbidity, mortality, and/or charges that might be improved if standards of primary care comparable to those of children with private insurance could be achieved.

METHODS. We conducted a retrospective comparison of hospitalization-related outcomes for children <18 years of age in Colorado from 1995–2003 and in the United States in 2000. Population-based rates for hospital admission were determined stratified by age, race/ethnicity, disease grouping, and health insurance status.

RESULTS. Compared with those with private insurance, children in Colorado and the United States with public or no insurance have significantly higher rates of total hospital admission, as well as admission for chronic illness, asthma, diabetes, vaccine-preventable disease, psychiatric disease, and ruptured appendix. These children have higher mortality rates, higher severity of illness, are more likely to be admitted through the emergency department and have significantly higher hospital charges per insured child. Higher hospitalization rates occur in children who are nonwhite and/or Hispanic and those who are younger. If children with public or no health insurance in the United States in 2000 had the same hospitalization outcomes as children with private insurance, \$5.3 billion in hospital charges could have been saved.

CONCLUSIONS. There is an opportunity to achieve improved health outcomes and decreased hospitalization costs for children with public or no health insurance if private insurance standards of health care could be achieved for all US children.

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Key Words

morbidity/mortality, cost-effectiveness, outcomes analysis, health services, hospitalization

Abbreviations

SCHIP—State Children's Health Insurance Program

CHA—Colorado Hospital Association

APR-DRG—all-patient refined diagnosis-related group

MDC—major diagnostic category

KID—Kids' Inpatient Database

UFFS—unassigned fee-for-service

CI—confidence interval

ICD-9—*International Classification of Diseases—Ninth Revision*

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THE US CENSUS reports that 34.1% of children <18 years of age were not covered by private health insurance at some time during 2003, a percentage that has been increasing in recent years; one third of these children went without any health insurance, with the remainder having some coverage through public health insurance programs, such as Medicaid and/or State Children's Health Insurance Program (SCHIP).¹ It has been estimated that an additional 7.7% of children with some health insurance coverage during the year may suffer from temporary gaps in that coverage.² It is reasonable to assume that lack of health insurance or gaps or insufficiency in its coverage may result in inferior health outcomes for children. Although it is widely believed that per capita health care expenditures are higher for children who are uninsured or are enrolled in public insurance programs compared with those children with private commercial health insurance, available data quantifying this difference are limited. We evaluated this hypothesis by analyzing hospitalization rates for children with private insurance as compared with those with public insurance or no insurance for a range of diseases and conditions to determine whether children with public or no health insurance have differences in hospital admission rates, morbidity, mortality, and/or charges that might be improved if standards of care comparable to those of children with private insurance could be achieved.

METHODS

Data Sources

This was a population-based analysis of hospitalization rates for children who were >28 days and <18 years of age in Colorado from 1995–2003 and separately for children in the United States in 2000. These 2 different populations were selected because Colorado data permitted comparison of the consistency of outcome measures over an extended period of time, whereas data accessibility limited extrapolation to the entire United States for only a single year. Hospitalization rates in Colorado were calculated using numerator data obtained from the Colorado Hospital Association (CHA) state inpatient database that contains standard administrative hospital discharge data grouped using the all-patient refined diagnosis-related group (APR-DRG) version 15 grouper codeveloped by the National Association of Children's Hospitals and Related Institutions and 3M Health Information Systems (Salt Lake City, UT). Diagnostic groupings were created using major diagnostic categories (MDCs) and *International Classification of Diseases, Ninth Revision* (ICD-9) diagnostic codes based on published precedents when possible (see "Appendix").^{3,4} Hospitalizations for MDC 14 (pregnancy-related conditions) and MDC 15 (birth-related conditions) were excluded. Health insurance status for each hospitalized

child was grouped as private (Blue Cross/Blue Shield, commercial insurance/indemnity plans/self insured, other liability insurance/no fault/casualty, or health maintenance organization-preferred provider organization/managed care/discounted) or public/none (self-pay, no charge/charity/research, other, Colorado Medically Indigent, Medicare, Medicaid, worker's compensation, Campus, or other government).

A preliminary analysis of Medicaid/SCHIP hospitalization rates tended to overestimate the difference between public insurance outcomes as compared with private insurance, because it included a disproportionate number of the hospitalizations of initially uninsured children who were retroactively qualified for Medicaid without a similar adjustment being possible for the denominator (at the major pediatric Medicaid hospital provider in Colorado, reclassification to Medicaid status is estimated to occur in >50% of initially "uninsured" cases). We, therefore, elected to combine uninsured hospitalized children with those having public insurance to better reconcile available data for rate calculations. No adjustment for multiple hospital admissions for individual children could be made because of the lack of identifiers within the CHA database.

Using DataFerrett, a collaborative tool developed by the US Bureau of the Census and the Centers for Disease Control to extract census data to estimate health insurance coverage, we obtained estimates for Colorado children <18 years of age from 1995–2003 grouped as private insurance or public/none (calculated as total children <18 years minus those with private insurance during any portion of that year) commensurate with the numerator classification combining uninsured and publicly insured children.⁵ Denominator estimates included children <28 days of age. We were able to obtain these estimates for insured populations in the United States broken down by age category and race/ethnicity; however, reliable denominator stratification at the state level was not possible because of the large confidence intervals associated with decreasing sample size.

US hospitalization rates for children <18 years of age were calculated by using identical methods and definitions using weighted hospitalization estimates from the Kids' Inpatient Database (KID) from the Healthcare Cost and Utilization Project for the year 2000.⁶ Age stratification of results was based on categories determined by the KID 2000 data structure, because a number of states provided only age-aggregated data to the KID 2000 database. Stratification by race and ethnicity was performed using consistent coding used by the CHA and KID. Two groups were created: white/non-Hispanic and nonwhite and/or Hispanic, the latter group including all of those indicated as Hispanic, Indian, Asian, and/or black.

Monthly insurance coverage denominator data were available from the Colorado Department of Health Care

Policy and Financing for Colorado children covered by Medicaid from July 1997 through November 2003 that provided estimates for the numbers of children who had selected or were assigned to a primary care physician (health maintenance organization or primary care physician program) as compared with those in an unassigned fee-for-service (UFFS) Medicaid category. This permitted a correlation of Medicaid hospital admissions in the CHA database with the number and percentage of children with each type of Medicaid insurance by month over this time frame.

Outcome Variables

Hospitalization rates were calculated for: all hospitalizations; hospitalization via the emergency department; children hospitalized with an APR-DRG severity score >2; chronic disease; and ambulatory care-sensitive conditions, including asthma, diabetes, vaccine preventable disease (excluding influenza), psychiatric disease (MDC 19), and appendicitis because of a ruptured appendix or with peritonitis (see "Appendix").³ For Colorado, total hospital charges for years 1995 through 2002 were adjusted to 2003 prices using the Consumer Price Index. US and regional hospitalization charges were based on the actual charge estimate for the year 2000 as recorded in the KID 2000 database. Hospital charges per insured child were calculated by dividing the total hospital charges for hospitalized children by the total number of children in each insured group. The difference between the average hospital charges per child in the public or no-insurance group compared with the private insurance group multiplied by the total number of covered individuals in the public or no-insurance group yielded the potential excess hospital charge gap between these 2 populations. This gap represents the maximum savings that could potentially be achieved for children with public or no insurance if they had improved outcomes equivalent to children with private insurance. It was assumed that reported hospital charges represented some multiple of actual hospital costs.

Data Analysis

The numerator data for Colorado rate comparisons represented the actual numbers of reported events. Population estimates for health insurance coverage had relatively small SE estimates. We, therefore, compared the differences between the hospitalization rates for each year for children with private insurance and those with public or no insurance over the years 1995–2003 using the paired-samples *t* test for comparison of mean differences of SPSS 13 (SPSS Inc, Chicago, IL). For each disease category we defined "rate ratio" as the mean yearly rate for those with public or no health insurance for the years 1995–2003 divided by the rate of the analogous years for those with private insurance. Comparisons for US and regional rates for 2000 were calculated using the χ^2 test (Statcalc in EpiInfo 6, Centers for Disease Control and Prevention, Atlanta, GA) and reported as relative risks.

Logistic regression analysis for hospitalized Colorado children was conducted with insurance status as the dependent variable and race/ethnicity and chronic disease as the independent variables using SPSS 13. Linear regression was similarly accomplished for the monthly number of hospitalized Medicaid children correlated with the total number of children covered by Medicaid and the proportion of children within the UFFS group.

RESULTS

Population Characteristics

Table 1 shows the demographic characteristics of the populations of hospitalized children in Colorado for 2003 (the last year of our analysis) and the United States for 2000. The age distribution of hospitalized children in Colorado and the United States with public or no health insurance was significantly younger ($P < .0001$) than those with private health insurance with the former weighted toward young children and the latter toward older adolescents. There was a marked difference in race/ethnicity distribution of children with public or no

TABLE 1 Comparison of Hospitalization Demographics for Children >28 Days and <18 Years for Colorado (2003) and the United State (2000)

Demographic	Colorado 2003		<i>P</i>	US 2000		<i>P</i>
	Insurance			Insurance		
	Public or None	Private		Public or None	Private	
Insured population, <i>n</i>	360 000	803 000		21 814 000	50 499 000	
Hospitalized children, <i>n</i>	11 276	15 655		875 345	1 057 538	
Age, <i>n</i> (%)			<.0001			<.0001
<12 mo	3161 (28.0)	2337 (14.9)		176 389 (20.2)	141 024 (13.3)	
1–4 y	3343 (29.6)	4179 (26.7)		263 586 (30.1)	278 562 (26.3)	
5–9 y	1419 (12.6)	2360 (15.1)		155 096 (17.7)	193 328 (18.3)	
10–14 y	1788 (15.9)	3211 (20.5)		155 480 (17.8)	226 604 (21.4)	
15–17 y	1565 (13.9)	3568 (22.8)		124 794 (14.3)	218 020 (20.6)	
Race/ethnicity, <i>n</i> (%)			<.0001			<.0001
White/non-Hispanic	4346 (38.5)	9800 (62.6)		299 577 (34.2)	633 714 (59.9)	
Nonwhite and/or Hispanic	6930 (61.5)	5855 (37.4)		575 767 (65.8)	423 824 (40.1)	

health insurance in both Colorado and the United States with approximately two thirds of hospitalized children falling into the nonwhite and/or Hispanic category as compared with one third for those with private health insurance ($P < .0001$).

Colorado Hospitalization Rates

Figure 1 demonstrates a relatively stable rate of overall hospital admission for Colorado children with private insurance from 1995–2003 with consistently higher rates for children with public or no health insurance. Table 2 validates this observation, showing significantly higher hospitalization rates per 100 000 insured for children with public or no health insurance for: all hospitalizations from 1995–2003 (mean rate difference: 1333; 95% confidence interval [CI]: 873 to 1792) hospitalizations via the emergency department, higher severity hospitalizations (ie, APR-DRG severity score >2), chronic diseases, asthma, diabetes, psychiatric disease, and vaccine preventable disease, with the comparative rate ratio ranging between 1.46 and 2.17 times the private insurance rates. Comparisons of the difference between hospitalization rates stratified by APR-DRG MDC category from 1995–2003 (data not shown) for privately insured children and those with public or no insurance did not demonstrate significantly increased rates for MDCs 8, 16, 17, or 25 (musculoskeletal system and connective tissue; blood, blood forming organs, immunologic disorders; myeloproliferative, poorly differentiated neoplasms; or multiple significant trauma).

The percentage of children hospitalized via the emergency department was also significantly higher in children with public or no health insurance, whereas the hospitalization rate for appendectomy (rate ratio: 1.07;

95% CI: -3.7 to 16.8) was not significantly different between the 2 categories. The percentage of children with appendicitis who had a ruptured appendix and/or peritonitis was significantly higher in children with public or no health insurance. Children with public or no health insurance also had a significantly higher mortality rate per 100 000 insured children (mean rate difference: 6.5; 95% CI: 4.1 to 8.8; $P < .001$). Stepwise logistic regression analysis showed significant ($P < .002$) independent contributions from nonwhite and/or Hispanic race/ethnicity ($\beta = .812$), admission year ($\beta = -.010$), age in years ($\beta = -.047$), chronic disease ($\beta = .042$), and ambulatory-sensitive conditions ($\beta = .202$) for hospitalization of children with public or no health insurance. Chronic disease comprised 11.9% of all hospital admissions for children with public or no health insurance.

For the period from July 1997 through November 2003, when a breakdown of types of Medicaid coverage for Colorado children was available (primary care physician program, managed care, and UFFS), stepwise linear regression showed a significant direct correlation with monthly Medicaid admission rates and both the total number of children with Medicaid insurance (standardized $\beta = .248$; $P = .028$) and the proportion of those with UFFS classification (standardized $\beta = .292$; $P = .009$).

Colorado Hospital Charges

There were considerably higher CPI-adjusted hospital charges per insured child for the public or no insurance group compared with the private insurance group every year of the analysis (Table 2). The mean difference in excess adjusted charges was \$128 per insured child for

FIGURE 1
Colorado hospitalization rates per 100 000 for children age >28 days and <18 years according to insurance type for the years 1995–2003.



TABLE 2 Population-Based Hospitalization Outcomes by Insurance Status for Children in Colorado (1995–2003)

Hospitalization Rate per 100 000	Insurance		Mean Difference (95% CI)	Rate Ratio	P
	Public or None	Private			
All hospitalizations	3268	1935	1333 (873 to 1792)	1.69	<.001
Hospitalization via emergency department	1574	838	735 (545 to 925)	1.88	<.001
APR severity >2	437	247	189 (133 to 245)	1.76	<.001
Chronic disease	387	220	167 (108 to 225)	1.76	<.001
Asthma	193	118	75.1 (42.8 to 107)	1.64	.001
Diabetes	45.1	30.8	14.3 (5.1 to 23.5)	1.46	.007
Vaccine-preventable disease	67.9	31.3	36.6 (16.1 to 57.2)	2.17	.003
Psychiatric disease	341	194	147 (48.3 to 245)	1.76	.009
Appendectomy	95.6	89.0	6.6 (–3.7 to 16.8)	1.07	.180
Mortality rate	14.1	7.6	6.5 (4.1 to 8.8)	1.85	<.001
% hospitalization via emergency department	48.7	43.3	5.4 (4.1 to 6.6)	1.12	<.001
Ruptured appendix, %	40.2	32.2	7.9 (5.1 to 10.8)	1.25	<.001
Charges per insured, \$	380	252	128 (70 to 186)	1.51	.001

children with public or no health insurance as compared with those with private insurance over that time period. This differential in hospital charges per insured child with public or no insurance represented an estimated excess expenditure of \$46.1 million in 2003 for the state of Colorado as compared with those with private insurance.

US and Regional Hospitalization Rates

Table 3 shows similarly increased hospitalization rates for children with public or no health insurance for the United States for 2000 as compared with privately insured children in disease categories comparable to the longitudinal Colorado state analysis. Overall, there was an increased relative risk of higher mortality (2.38; 95% CI: 2.28 to 2.49) as well as condition-specific hospitalization rates for children with public or no health insurance with relative risks ranging from 1.20 to 2.37 times

more than children with private insurance. Nationally there was an estimated excess of 2378 deaths in the US in 2000 among children who had public or no health insurance as compared with those with private health insurance. In this year, there was also an estimated difference in national hospitalization charges for children with public or no health insurance of \$242 as compared with children with private health insurance. For the year 2000, this amounted to an estimated \$5.3 billion dollars in excess hospitalization charges for children with public or no health insurance as compared with children with private health insurance.

Although regional comparisons consistently showed similar differences for population-based hospitalization morbidity, mortality, and hospital charges between children with private insurance and public or no insurance (data not shown), quantitative differences between regions were also apparent. For example, per capita hos-

TABLE 3 Population-Based Hospitalization Outcomes by Insurance Status for Children in the United States for 2000

Measure	Cases		Rate per 100 000		Relative Risk (95% CI)
	Public or None	Private	Public or None	Private	
Population <18 y	21 814 000	50 499 000			
All hospitalizations	875 345	1 057 538	4012.8	2904.2	1.92 (1.91 to 1.92)
Hospitalization via emergency department	425 107	434 741	1948.8	860.9	2.26 (2.25 to 2.27)
Chronic disease	131 459	138 587	602.6	274.4	2.20 (2.18 to 2.21)
Asthma	49 570	48 475	227.2	96.0	2.37 (2.34 to 2.40)
Diabetes	14 341	23 853	65.7	47.2	1.39 (1.36 to 1.42)
Vaccine-preventable disease	6712	6900	30.8	13.9	2.25 (2.18 to 2.33)
Psychiatric disease	71 639	78 707	328.4	155.9	2.11 (2.09 to 2.13)
Appendectomy	27 777	53 607	127.3	106.2	1.20 (1.18 to 1.22)
Mortality rate	4087	3982	18.7	7.9	2.38 (2.27 to 2.48)
% hospitalization via emergency department	48.6	41.1			1.18 (1.18 to 1.19)
Ruptured appendix, %	(35.2) ^a	(27.6) ^a			1.25 (1.23 to 1.28)
Charges, \$ in millions	(10 165) ^b	(11 301) ^b	(466) ^c	(224) ^c	2.08

^a Percentage of appendicitis cases ruptured.

^b Hospital charges in \$ millions.

^c Hospital charges per insured per year.

pital charges for both groups were lower in the South and Midwest compared with higher per capita charges in the Northeast and West.

Using age categories available in KID 2000, hospitalization rates were calculated for insurance groups as determined by race/ethnicity. Rates were highest in young children (<5 years of age), decreased in school-aged children, and increased in older teenagers (Fig 2). Over the 5 age groups, children with public or no health insurance had significantly higher hospitalization rates in both the nonwhite and/or Hispanic and white/non-Hispanic racial/ethnic groups when compared with age group-aggregated children with private insurance ($P = .043$, Wilcoxon signed-ranks test). Similarly, over the 5 age groups, nonwhite and/or Hispanic children had significantly higher hospitalization rates in both the public or no health insurance and private insurance groups when compared with age group-matched white/non-Hispanic children ($P = .043$, Wilcoxon signed-ranks test).

DISCUSSION

This study documents significantly higher rates of condition-specific, hospitalization-associated morbidity, mortality, and charges for children with public or no health insurance as compared with children with private health insurance in both Colorado and the United States. It is reasonable to hypothesize that inadequate insurance coverage may be one factor that adversely impacts access to preventive and acute primary care resulting in greater emergency department use and hospitalization-associated morbidity and mortality along with their resultant increased costs. In Colorado, physicians have been reimbursed by Medicaid at ~50% of overhead cost and hospitals at 70% of actual cost.⁷ Such low public insurance payment rates may result in a reduction in access to primary health care physicians and/or decreased fi-

nancial viability of providers (physician practices and hospitals) resulting in cost shifting with a commensurate increase in private sector health costs.⁸⁻¹² Low reimbursement rates and administrative inefficiencies may compromise the ability of Medicaid to assure the equal access statute that mandates that enrollees receive care comparable to that received by children with private insurance.^{7,13} Our study demonstrates such inequities in hospitalization-associated outcomes.

In a previous study, we demonstrated that children enrolled in the Colorado unassigned fee-for-service Medicaid program were less likely to have a usual source of primary care resulting in decreased primary care visits, decreased preventive care, and poorer vaccination status.⁷ In this current study, children covered by Medicaid who did not have an assigned or selected primary care physician (UFFS) were associated with a significantly higher hospital admission rate. Similarly, Mitchell and Gaskin¹⁴ reported access problems in children with special health care needs with fee-for-service Medicaid coverage as compared with those with managed care coverage. Olson et al² have shown that children from low-income families are more likely than children from middle- and high-income families to be uninsured or covered by public insurance and less likely to have had a medical office visit or a dental visit, less likely to have medicines prescribed, and more likely to have used an emergency department. Insurance status may also impact access to urgent ambulatory care follow-up appointments.¹⁵

Our results show significantly higher hospitalization rates for children with public or no insurance having ambulatory care-sensitive conditions, such as asthma, vaccine-preventable disease, psychiatric conditions, and diabetic ketoacidosis. The fact that insurance-associated differences were identified for these conditions but not those unlikely to be altered by primary care (eg, appendectomy, childhood cancer, trauma, and orthopedic disorders) in Colorado suggests that these results are not artifacts of our rate calculation methodology. This is further supported by the significantly higher percentage of children with public or no insurance admitted through the emergency department and the observation that the rate ratio for children with public or no health insurance hospitalized in Colorado with a ruptured appendix as compared with those with private insurance was 1.25 ($P < .001$), whereas the difference in appendectomy rates between the insurance groups was minimal (1.07; $P = .180$). Similar findings have been reported in other studies.^{3,16-18} O'Toole et al¹⁹ reported higher ruptured appendix rates associated with a longer duration of symptoms in children with Medicaid insurance.

Outcome equity is not solely dependent on the quantity or quality of health insurance given the demographic and cultural differences noted between our in-

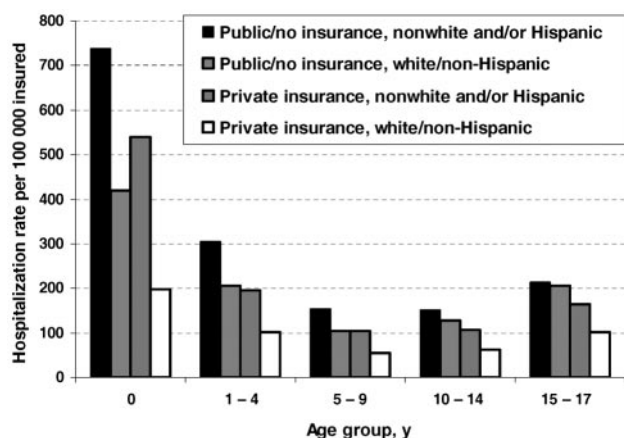


FIGURE 2

Population-based rates of hospitalization according to insurance status and race/ethnicity for children in the United States for the year 2000.

sured populations. In hospitalized Colorado children, age, race/ethnicity, and chronic disease status all correlated independently with insurance status. Public health insurance programs have a disproportionate number of young children, are disproportionately nonwhite and/or Hispanic, and serve families with low income that qualifies them for Medicaid or SCHIP.^{20,21} In the United States, our data show that nonwhite and/or Hispanic children have higher hospitalization rates even if they have private insurance. Genetic factors, socioeconomic factors, and environmental conditions may affect the disease burden of some clinical conditions and may also affect care-seeking behaviors and compliance.^{22,23} Nonetheless, when controlling for age and race/ethnicity, hospitalization rates were still significantly higher in the United States in the public or no insurance group suggesting structural failures in the available system of care.

The observation that children with public or no health insurance have inferior health outcomes when compared with children with private health insurance should not lead to the conclusion that such outcomes could not be improved or that public insurance systems are inherently flawed. Medicaid and SCHIP are methods for paying for health care, not for providing it. We combined the public and no-insurance groups solely because data limitations would have otherwise resulted in an overestimate of the excess morbidity and charges associated with publicly insured children. From a purely financial point of view, if the provision of consistent primary care for all children (including systems to address racial/ethnic differences in the use and efficacy of primary care) could provide the same hospitalization outcomes for the public or no-health insurance children that are achieved for those with private insurance, a substantial proportion of \$46 million of excess hospital charges in Colorado in 2003 and \$5.3 billion in the United States in 2000 might have been saved and, along with commensurate reductions in emergency department use, used to partially offset the increase in primary care access and services. Cohen¹² has shown that having a private-practice physician as a usual source of care can decrease total physician Medicaid expenses by as much as one third. A recent study also shows a marked reduction in emergency department use (and costs) by Medicaid patients with regular access to pediatric care.²⁴ There is evidence that enrollment in SCHIP can improve such access.^{25,26}

The President's "New Freedom" initiative has articulated the essential goals for children with special health care needs that include having access to ongoing, comprehensive health care and adequate insurance for these services,²⁷ and, yet, a recent study demonstrates that >40% of even these most vulnerable children do not meet these criteria.²⁸ Provision of public insurance coverage for children in the United States is not sufficient to assure high-quality outcomes if that coverage has gaps

or does not provide access to effective primary and preventive care.^{29–31} Allocating the dollars associated with excess hospital use of children with public or no health insurance (\$5.3 billion in excess charges for the United States in 2000) to improve access to and efficacy of primary care for these same children would not entirely offset the expenditure required for effective health insurance coverage, but it would provide a significant financial incentive for making quality health care for all US children the ethical priority that it should be.

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APPENDIX. ICD-9 Definitions of Clinical Categories

Category	ICD-9 and MDC Codes
Appendectomy for appendicitis	(Px: 470 or 470.2 or 470.9) and (Dx: 540.0 or 540.1 or 540.9)
Appendectomy for appendicitis with rupture or peritonitis	(Px: 470 or 470.2 or 470.9) and (Dx: 540.0 or 540.1)
Vaccine-preventable disease	
Diphtheria	032.x
Pertussis	033, 033.0, 033.9, 484.3
Tetanus	037
<i>Haemophilus influenzae</i>	320.0, 038.41, 041.5, 482.2
Varicella	052.x
Hepatitis A	070.0, 070.1
Hepatitis B	070.2, 070.3
Measles	055.x
<i>Streptococcus pneumoniae</i>	038.2, 041.2, 320.1, 481, 567.1
Psychiatric disease	MDC 19
Asthma	493.x
Diabetes	250.x
Chronic Disease	
Neuromuscular	
Brain and spinal cord malformations	740.0–742.9
Mental retardation	318.0–318.2
Central nervous system degeneration and disease	330.0–330.9, 334.0–334.2, 335.0–335.9
Infantile cerebral palsy	343.0–343.9
Muscular dystrophies and myopathies	359.0–359.3
Cardiovascular	
Heart and great vessel malformations	745.0–747.4
Cardiomyopathies	425.0–425.4, 429.1
Conduction disorders	426.0–427.4
Dysrhythmias	427.6–427.9
Respiratory	
Respiratory malformations	748.0–748.9
Chronic respiratory disease	770.7
Cystic fibrosis	277.0
Renal	
Congenital anomalies	753.0–753.9
Chronic renal failure	585
Gastrointestinal	
Congenital anomalies	750.3, 751.1–751.3, 751.6–751.9
Chronic liver disease and cirrhosis	571.4–571.9
Inflammatory bowel disease	555.0–556.9
Hematologic or immunologic	
Sickle cell disease	282.5–282.6
Hereditary anemias	282.0–282.4
Hereditary immunodeficiency	279.00–279.9, 288.1–288.2, 446.1
Acquired immunodeficiency	0420–0421
Metabolic	
Amino acid metabolism	270.0–270.9
Carbohydrate metabolism	271.0–271.9
Lipid metabolism	272.0–272.9
Storage disorders	277.3–277.5
Other metabolic disorders	275.0–275.3, 277.2, 277.4, 277.6, 277.8–277.9
Other congenital or genetic defect	
Chromosomal anomalies	758.0–758.9
Bone and joint anomalies	259.4, 737.3, 756.0–756.5
Diaphragm and abdominal wall	553.3, 756.6–756.7
Other congenital anomalies	759.7–759.9
Malignancy: malignant neoplasms	140.0–208.9, 235.0–239.9

Px indicates procedure code; Dx, diagnosis code.

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